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ABSTRACT

GRADES OR AGES: Not given. SUBJECT MATTER: Biology, the structure and physiology of the cell. ORGANIZATION AND PHYSICAL APPEARANCE: There are four sections: a) objectives for the unit, b) bibliography, c) activities, and d) evaluation. The guide is directed to the student rather than the teacher. The guide is mimeographed and stapled, with no cover. OBJECTIVES AND ACTIVITIES: The objectives for the unit are detailed in section one. Activities form the major part of the guide and include the use of a compound microscope and the microscopic examination of a cell. INSTRUCTIONAL MATERIALS: Materials needed for each activity are listed, and there is a brief bibliography. STUDENT ASSESSMENT: A one-hour examination is specified, and examination questions are included in the guide. (MBM)

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BIOLOGY 23

UNIT I - THE CELL: STRUCTURE & PHYSIOLOGY

CONTENTS:

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IV EVALUATION

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NEDERLAND INDEPENDENT SCHOOL DISTRICT

To the Student:

The earth is populated by millions of different types of living creatures. Each has its own way of living, but all share the only known kind of basic structure - that means being alive. No matter how different plants, animals and other creatures are, they solve the problem of staying alive in much the same way.

In this course you will investigate what biologists have discovered about life - what makes something living and how each species is continued. To begin this investigation, the basic structure of life will be taken up. This structure is The Cell.

THE CELL: STRUCTURE AND PHYSIOLOGY

I. Objectives for Unit I.

A. Use a Microscope

1. Demonstrate the ability to label the parts of a microscope on a drawing.

2. Demonstrate the ability to focus a microscope on a microscopic object.

B. Identify the function of the following terms as they apply to both plant and animal cells.

C. Demonstrate a knowledge of the function of the following list of parts of a cell:

1. Cell wall

2. Cytoplasm

3. Nucleus

4. Chromosomes

5. Golgi bodies

6. Ribosomes

7. Deoxyribonucleic acid

8. Ribonucluic acid

9. Mitochondrion

10. Endoplasmic reticulum

D. Demonstrate the ability to write a definition of the following list of terms:

1. Morphology

2. Physiology

3. Diploid

4. Haploid

5. Differentially permeable
6. Mitosis
7. Unicellular
8. Cell
9. Protoplasm

E. Explain in a brief paragraph the meaning ot the "cell theory" according to the text.

F. Demonstrate a knowledge of a cell.

1. Demonstrate the ability to draw the outline of a cell from a sketch found in the text or a reference book and include the parts common to both kinds of cells.
2. Demonstrate the ability to label the parts given in Objective "C" of the cell.

G. Demonstrate the ability to write a 150 word essay on Robert Hooke's contribution to the knowledge of cells.

H. Demonstrate a knowledge of the difference between a plant cell and an animal cell.

I. Demonstrate a knowledge of Mitosis

1. Demonstrate the ability to identify the five phases of mitosis on slides of onion root tips.
2. Demonstrate by sketches knowledge of the progression of the five phases of mitosis.
3. Demonstrate by statements a knowledge of the progress of the five phases of mitosis.

J. Demonstrate the ability to locate with a microscope the following list of cell parts on slides of onion skin cells:

   1. Nucleus
   2. Cytoplasm
   3. Cell membrane

K. Demonstrate a knowledge of the scientific term used in the measurement of cells.

L. Demonstrate the ability to explain in a 150 word essay why there is no "typical cell." This will be your own conclusions drawn from the readings in this unit.

M. Demonstrate the ability to write an essay of 150 words on the transition from a cell to a complex organism. Begin with the aggregation of cells into tissues; tissues into organs; organs into organ systems; and organ systems into complex organisms.

II. BIBLIOGRAPHY

A. Text - Biological Science - An Inquiry Into Life

B. References

1. Biology - Introduction to Life, Nason and Goldstein

2. Biology, Kimball

3. Microbes and Men, Simon

4. Principles of Genetics, Gardner

5. Microbiology, Burdon and Williams

6. The Plant World, Fuller and Carothers

7. Biology for Today, Clark and Mound

8. General Biology, Beaver

9. Biology - Introduction to Life, Goldstein and Edwards (Teachers Guide)

III. Activities for Unit I.

To the Student: Read all of the activities in Unit I before beginning.

A. Use a Microscope

1. Schedule with the teacher a lab on the use of a compound microscope.
2. Read pp. 1, 2, and 3 of Lab Sheet I before attending lab. (Lab Sheet 1 follows this page).
3. Follow procedures A, B, and C on Lab Sheet I during Lab I.
4. Write the answers to the questions on pp. 2 and 3 of Lab Sheet I. on notebook paper during Lab I.

Lab Sheet I.

Name:_____Date:_____

LEARNING TO USE THE COMPOUND MICROSCOPE:

Rules for care of the microscope:

The compound microscope is an expensive instrument and must be given proper care. Here are some basic rules to remember in using the compound microscope.

1. Always carry the microscope by the arm and support it at the base using both hands. Do not swing the microscope because the eyepiece (ocular) may fall out of the body tube and crack.

2. Never rest the microscope at the edge of your work table. Place it several inches from the edge.

3. Never tilt the microscope when using a wet mount. The water and the material you are looking at will run off the slide and wet the stage.

4. Tilt the microscope only when using a dry mount. Never leave the microscope in a tilted position.

5. If the lenses of the microscope are not clean, use dry lens paper to clean them. The mirror can be cleaned this way also. If you find that wiping with the lens paper is not sufficient to clean the lenses, mention this to your teacher.

6. When you have finished using the microscope, remove the slide you were studying. Wipe the lenses with lens paper. Dry the stage if necessary.

7. Before returning the microscope to the storage cabinet, do the following:

   a. Turn the nosepiece so that neither objective lens is above the hole on the stage. The body tube should be positioned so that the objectives are about 1/2 inch above the stage.

   b. Place the mirror in a horizontal positioned.

   c. Place the clips in a parallel position, resting on the stage, and secure in the clip holes.

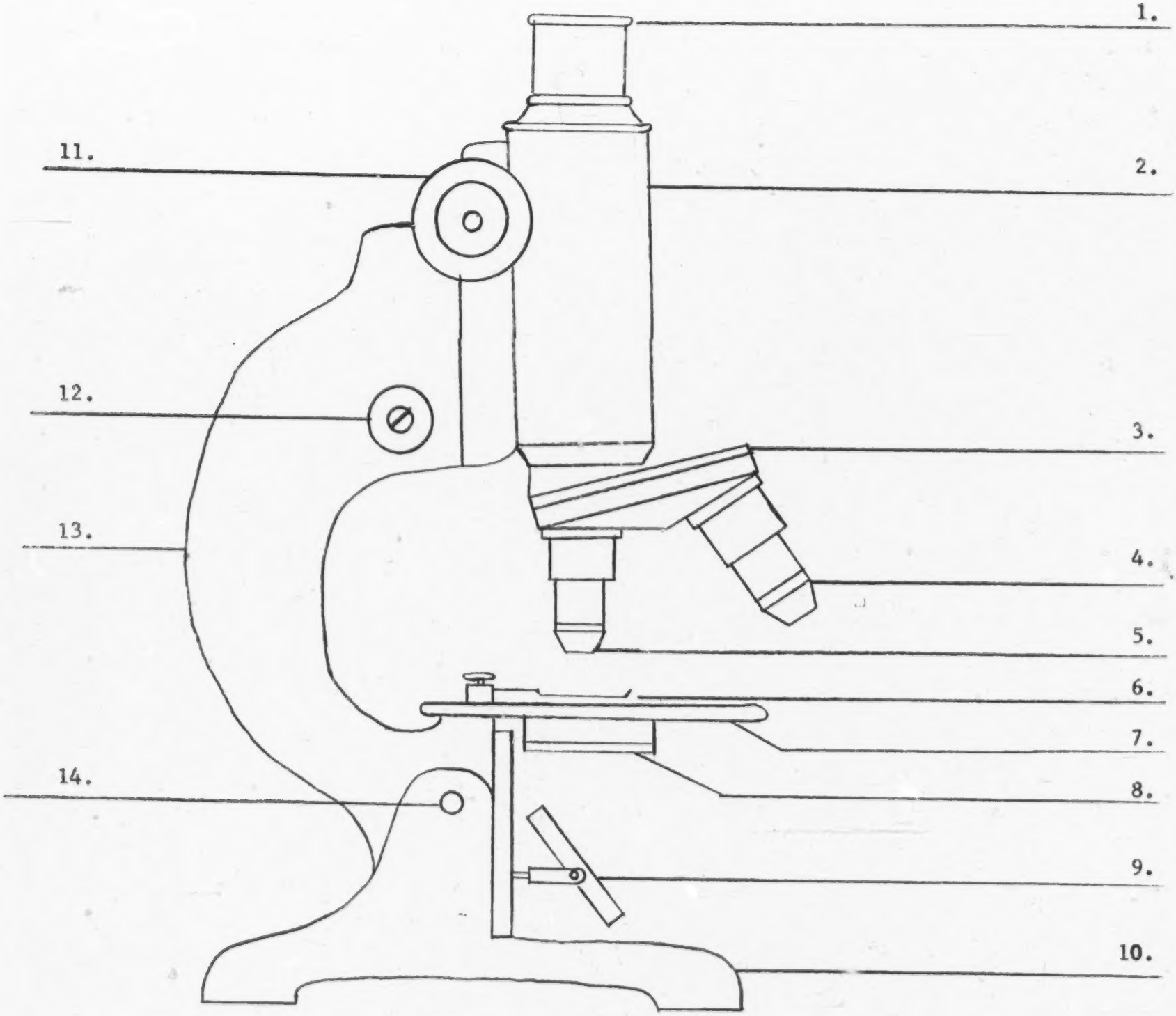
8. If an electric microscope is used, be sure the light is off after it is used.

MATERIALS:

1. Compound microscope

2. Prepared slide of letter "e"

3. Lens paper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Procedure A: Becoming familiar with the microscope

1. Place the microscope on the table with the arm toward you and the stage away from you. The base must be several inches in from the edge of the table.

2. Locate the parts of the microscope shown in the diagram.

3. Learn the names of the parts in the diagram, as given in the table of the following page.

4. Be prepared to name these parts before leaving the lab.

Procedure B: How to focus the microscope using low power.

1. Turn the nosepiece so that the low-power objective is directly over the hole on the stage in line with the body tube. It will click into place.

2. Look through the eyepiece. Turn on the light or adjust your mirror so that you get the best circle of light possible on your field. If you are not using a substage lamp, use the flat side of the mirror. The entire field should be evenly illuminated.

PART NO.	NAME OF PART	FUNCTION OF PART
1	Eyepiece (ocular)	Contains magnifying lens we look through.
2	Body Tube	Holds the lenses of the eyepiece and the objectives at a set distance from each other.
3	Revolving nosepiece	Holds the objective lenses and permits their interchange.
4	High-power Objective	Magnifies 43X
5	Low-power Objective	Magnifies 10X; it is shorter than the high power objective
6	Clips	Hold the slide in place.
7	Stage	Holds the slide; a hole in the center admits light.
8	Diaphragm	Regulated light that passes through the hole.
9	Mirrow or Light	Reflects light up through the diaphragm.
10	Base	Supports the weight of the microscope.
11	Coarse Adjustment	Moves the body tube up and down; used for low-power focusing.
12	Fine Adjustment	Sharpens the image under high power.
13	Arm	Supports the body tube and the adjustments; the microscope is carried by this part.
14	Inclination Joint	Permits the tilting of the body tube and attached parts.

3. You have been given a slide of the letter "e". Examine this slide with the naked eye and proceed with Item 1. of the Observations.

4. Now place the slide on the stage. The "e" should be positioned over the center of the hole on the stage and the letter must be right-side-up.

5. Clip the slide into place.

6. With your eyes at the level of the stage, not looking through the eyepiece, use the coarse adjustment to lower the low-power objective until the stop is reached. If your microscope has no low-power stop, lower the objective until it is about 1/4 inch from the stage.

7. Using only one eye, look into the eyepiece. (Keep the other eye open to avoid eye strain). Raise the objective slowly by turning the coarse adjustment toward you. Stop when you bring the object into view.

8. If you do not locate your material and the objective has been raised until it is more than 1/2 inch away from the stage, repeat Item 6. Caution: Never lower an object while looking through the eye-piece.

9. If the letter "e" is not in the center of the field, move the slide gently to center the "e". Sharpen the focus by using the fine adjustment.

10. Complete Items 2, 3, and 4 in the Observations.

OBSERVATIONS:

1. Draw the "e" as it looks on the slide when seen with the naked eye. Make sure that size and position are accurate.

2. Draw the "e" as you see it under the low-power objective of your microscope. Be as accurate as you can with the position and size of the letter.

3. Describe the changes in position of the "e" as seen under low power of the microscope as compared with seeing it with the naked eye.

4. Move the slide in each of the positions directed below. Record your results.

a. To the right

b. To the left

c. Toward you

d. Away from you

e. Rotate clockwise

f. Rotate counterclockwise

Procedure C: How to Focus Under High Power

1. Make sure that your material is focused well under low power. Check to see that the letter "e" is in the center of the field of vision.

2. Turn the mirror to the concave side and adjust it so that you have the best light possible or turn on the light.

3. Rotate the nosepiece so that the high-power objective clicks into place.

4. Sharpen the focus by using only the fine adjustment. If you have difficulty in locating the specimen, you must begin again by focusing under low power. Remember: Do not lower the high-power objective while you are looking through the eyepiece.

5. If you have located the material, proceed with Item 1. in the Observations.

OBSERVATIONS:

1. Turn the nosepiece to the high power objective. How much of the "e" is seen now compared to the view under low power? Draw what you see.

B. Write the function of the following list of parts of a cell as they apply to both plant and animal cells. You may need to use reference books as well as the text.

1. Cytoplasm
2. Cell Wall
3. Nucleus
4. Chromosomes
5. Golgi bodies
6. Ribosomes
7. Deoxyribonucleic acid
8. Ribonucleic acid
9. Mitochondrion
10. Endoplasmic reticulum

C. Write a one sentence definition of the following list of terms:

1. Morphology
2. Physiology
3. Diploid
4. Haploid
5. Differentially permeable
6. Mitosis
7. Unicellular
8. Cell
9. Protoplasm

D. Read Chapter 3, pp. 44-59 in your text.

E. Write a brief paragraph on the meaning of the "cell theory" according to the text.

F. Write an essay of 150 words on Robert Hooke's contribution to the knowledge of cells. Use at least one reference other than the text. List the references at the end of the essay. Submit the essay to your teacher.

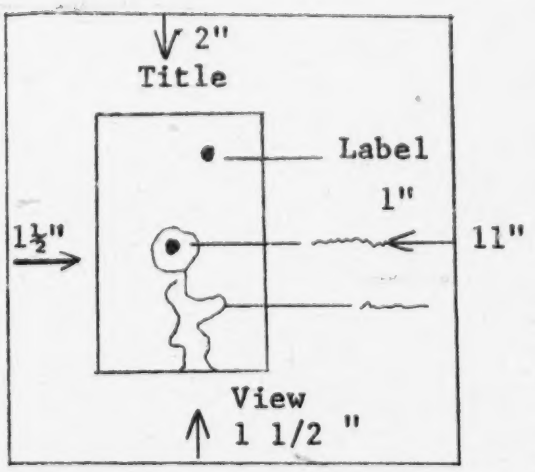
G. Read the following list of pages in the text on the Physiology of the Cell.

1. PP. 59-64
2. PP. 122-129
3. PP. 136-137
4. PP. 341-342

H. Draw the outline of a cell from a sketch found in the text or a reference book. Include in the drawing the differences in a plant and animal cell. Follow the rules given on page_____.

I. Label the parts of the general cell drawing using the terms in Activity II. Follow the rules given on page_____.

Example of Drawing:



Rules:

All drawings turned in will follow the same plan.

1. Size and type of paper - 8½ X 11" white, unlined.
2. Drawing should fill space within margins.
3. Margins: Top - 2"
   Bottom - 1½"
   Left - 1½"
   Right - 1"
4. All margins should be free of words or drawings.

5. Title - 2" from the top and all capital letters - centered within margins and printed.

6. View - center at bottom. Only 1st letter of each word is capitalized. Print.

7. Labels - a. Use pencil only
   b. Use ruler for guidelines
   c. All labels end at right margin
   d. Only first letter is capitalized
   e. Print

8. Drawings should be done in pencil and colored with pencil colors.

J. Read chapter 7 on Reproduction of Cells. Pages to read are 140 - 148.

K. Write an answer to each of the questions 5, 6, 7, 8, and 9 on page 153 of the text.

L. Write in order the names of the five phases of mitosis. These can be found in a reference book.

M. Describe in a brief paragraph the changes occurring in a cell during each of the five phases of mitosis.

N. Schedule with the teacher a Lab II on The Cell.

O. Read Lab Sheet II before attending lab.

P. Follow procedures A, B, and C given on Lab Sheet II during scheduled lab period. Bring to lab the following materials:

1. Drawing paper - 8½ X 11"
2. Pencils
3. Pencil colors
4. List of parts of cell with functions written out
5. Labeled drawing of cell
6. Lab Sheet II
7. Text
8. Description of changes occurring during mitosis

Lab Sheet II.

Name:_____Date:_____

THE CELL:

Background Information

Is an onion bulb living or dead? If you have ever seen an onion that has been stored for a long period of time in a damp place, the answer to this question then becomes obvious. The onion bulb is composed of many living cells which are capable of growing into roots and leaves when the proper conditions are present. Unlike the cells of cork, living cells are made of living material. In this exercise you will see living cells and their parts which are necessary for life processes.

Materials

1. Compound microscope
2. Onion bulb
3. Lugol's iodine solution
4. Forceps
5. Two slides
6. Two cover slips
7. Medicine-dropper pipette

Procedure A: The Unstained Cell

1. Place a drop of tap water in the center of a clean slide.
2. Separate the leaves (scales) of a piece of onion bulb that you have received.
3. Hold the section of onion with the concave side up. Using the forceps, strip off the thin membrane that lines the inner side, as shown in the drawing.
4. Place a small piece of the membrane in the drop of water on the slide with the outer side up.

5. Put another drop of water over the membrane and cover it with the cover slip. Tap out the air bubbles.

6. Examine the slide under low power (10 X).

7. Switch to high power and study a single intact cell for detail. When using high power, you must constantly use the fine adjustment to bring out the details of the cell.

Observations:

1. Draw a diagram of at least six cells as they appear under low power. Label as many of the parts given in objective "B" as possible.

2. Draw a diagram of a single cell that you have examined closely under high power. Label as many parts given in objective "B" as possible.

3. Write a brief summary of the differences you noted in your specimen as you studied it under high power as compared to low power.

Procedure B: The Stained Cell

1. Using a piece of paper toweling, draw off the water from your slide. Run some iodine solution under the cover slip. Blot the excess stain with the paper toweling.

2. Locate the cells under low power and then study individual cells under high power.

Observations:

1. Draw a stained cell. Label as many parts as you can.

2. Using the fine adjustment, focus sharply on the nucelus. What do you see?

3. Focus sharply on the cytoplasm. Do you note any structures that were not so clearly defined in the unstained cell?

Procedure C: Dividing Cell - Mitosis

Look at the prepared slides of onion root tip. All five phases may be present on one slide. Use low then high power for drawings.

1. Locate a cell not dividing. Draw it. (High power)

2. Draw the best example of each stage you can locate.

3. Why are cells from a root tip selected for the study of mitosis?

Optional Material: See your teacher now

Q. Submit to the teacher all of the following before scheduling the unit examination.

   1. Make a flip-book to illustrate mitosis as a continuous process. You must decide the number of drawings necessary to show the movement of the chromosomes from the undivided cell to the daughter cells.

   2. Make a more detailed study of the physiology of the cell using the terms already defined and draw your own conclusions as to the advantages and disadvantages of the specialization and division of labor among cells of an animal. Write a 200 word essay on your findings. List all references used at the end of the essay. At least two references must be used.

   3. Prove the "cell theory." To do this you may examine with a microscope fragments of a variety of plant cells. When making the slides to study be sure the slices of plants are paper-thin. Make drawings of at least five plant cells observed and label. Then draw your conclusions as to the validity of the cell theory.

R. Schedule with your teacher a one hour unit examination.

IV. Evaluation:

A. Copy the following phrases. After each one, write the name of the cell part most closely associated with it.

1. Master of the cell
2. Differentially permeable
3. "Powerhouse" of the cell
4. Site for protein synthesis
5. Tremendous internal surface for cell activities

B. Match the term on the left with the definition or function on the right. Write the letter in the blank at the left.

_____1. Morphology
_____2. Physiology
_____3. Cell Wall
_____4. Golgi bodies
_____5. Unicellular
_____6. DNA
_____7. Metochondrion
_____8. Cytoplasm
_____9. RNA
_____10. Mitosis

a. One celled
b. Curved membranes with no ribosomes attached
c. Study of structure
d. Nucleic acid that carries instructions for hereditary traits
e. Ribonucleic acid
f. Non-living outer layer of plant cell
g. Protoplasm other than the nucleus
h. Process of cell division
i. Study of function
j. Provides energy for the cell
k. Particles which function in protein synthesis
l. Unit on which every living thing is built

C. Write in order the five phases of mitosis.

1.

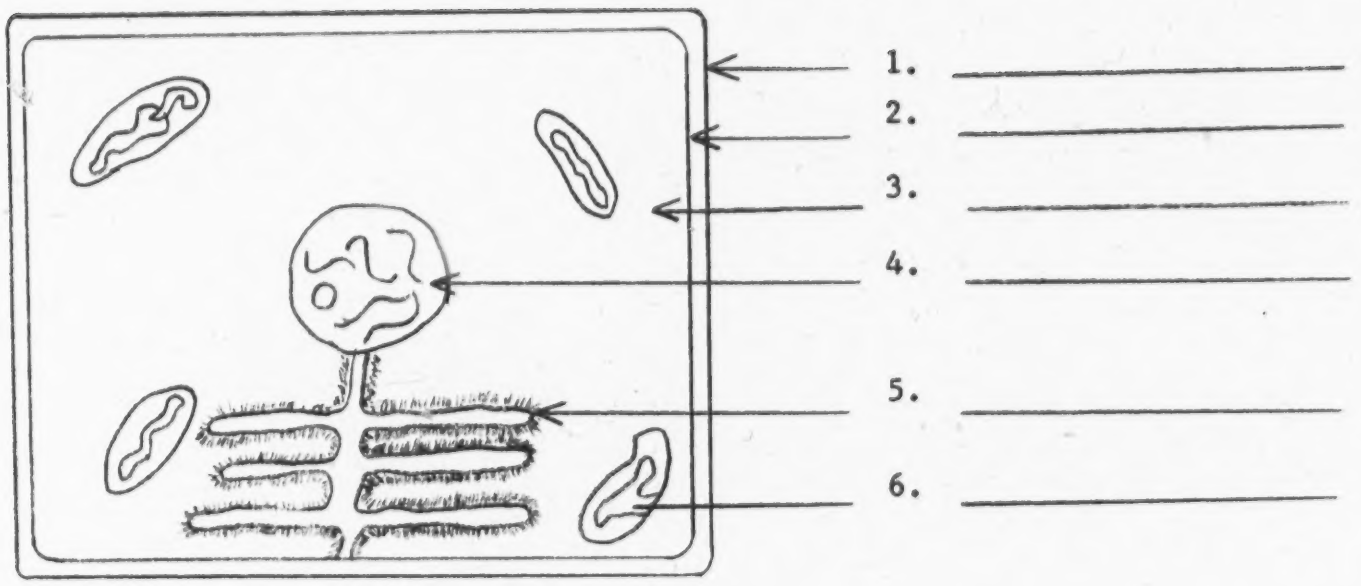
2.

3.

4.

5.

D. Label the cell:



E. Fill in the blank with the correct name or term.

_____1. Man who discovered the cells in cork.

_____2. Phase of mitosis having the chromosomes lined up at the equator.

_____3. The now-living part of a plant cell that is not found in animal cell.

_____4. Write the three basic structures found in all cells (4-6).

_____5.

_____6.

_____7. What are the structures found in the nucleus which are visible only during mitosis?

_____8. Study of heredity.

_____ 9. Having one complete set of chromosomes.

_____10. Term for all the living contents of a cell.

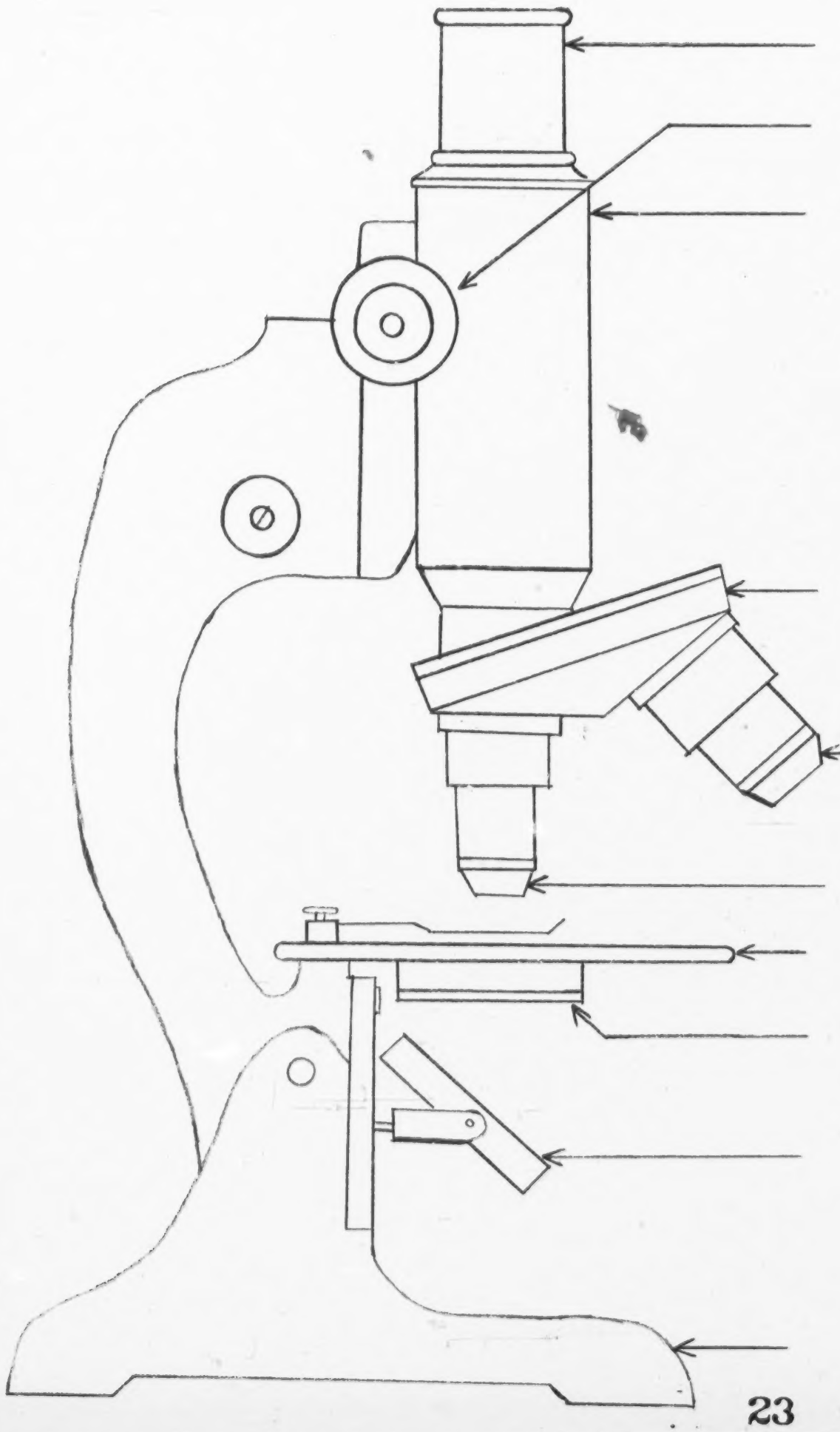
_____11. Having two complete sets of chromosomes.

_____12. The scientific unit used to measure cells is the.....

_____13. Selection by cell membrane of materials going in or out of the cell is called.....

_____14. The two cells resulting from mitosis are called.....

V. Label the Microscope



1. _____
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